TECHNOLOGY DRIVEN. WARFIGHTER FOCUSED.

U.S. Army/CERDEC's Portable Fuel Cell Evaluation and Field Testing

2011 Fuel Cell Seminar & Expo – Orlando, FL – 31 Oct 2011

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US ARMY/AMC/RDECOM/CERDEC/C2D/Army Power Division/Power Sources Branch

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An overview of the US Army CERDEC Portable Fuel Cell Evaluation and Field Testing program is summarized.

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US ARMY POWER DIVISION

MISSION

Conduct RDT&E, leading to the highest density, safest, most cost-effective energy technologies to meet the war fighter's portable & mobile application needs

Technologies

Wind, PV, batteries, fuel cells, generators, power electronics, environmental control units.

Partners

Include other DOD agencies, industry, academia

The Reusing Existing Natural Energy Wind and Solar (RENEWS) is a kit that enables the harvesting and utilization of wind and solar power.

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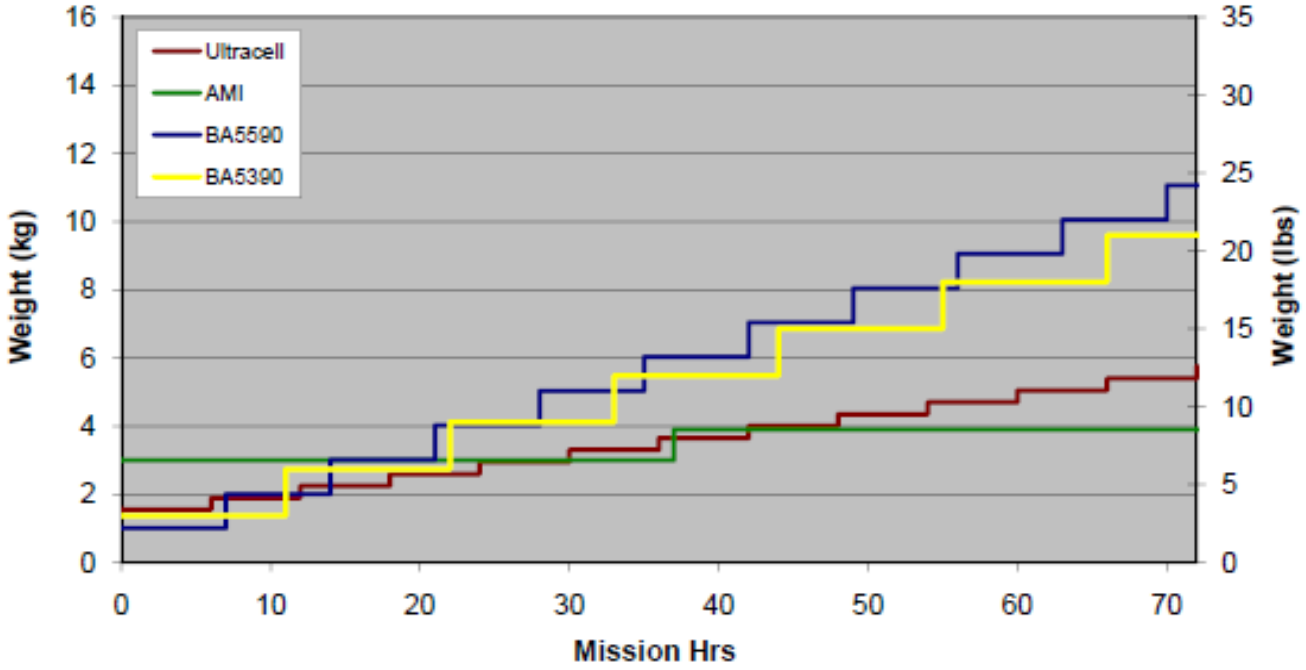
WARFIGHTER ENERGY OVERVIEW

- **Present battery solution significantly adds to soldier load burden**
- **In extended missions, fuel cells can potentially reduce soldier burden**
- **Developing and evaluating FC systems < 500W**



Comparison of FCs systems vs. primary Li batteries ($LiSO_2$, $LiMnO_2$)

Field Deployment of Systems

Limited User Test

- Power Excursion sponsored by PM Soldier Warrior
- Conducted at Fort Riley, KS.
- Systems demonstrated in Restrictive, Unrestrictive and Urban Terrain

System Deployment

- 7x-300W Propane Fuel Cells
- 7x-300W Methanol Fuel Cells
- 6x-55W Methanol Fuel Cells

300W AMI Propane System

Requirement	Specifications
Weight	*30 lbs w/ Internal Batteries*
Volume	*15.7" x 14" x 8"*
Internal Battery	*1x BB-2590*
Voltage: APU	*28 VDC*
Fuel	*Propane*
Runtime	*1lb Propane= 4 hrs*
MTBF	*1080 hrs*
Batteries Charged per Cartridge	*None: APU only*
Start-up/Shutdown Time	*25min / 25min*

300W Protonex Methanol System

Requirement	Specifications
Weight	*36lbs w/ Internal Batteries*
Volume	*15" x 12" x 10"*
Internal Battery	*2x BB-2590*
Voltage: APU	*28 VDC*
Fuel	*Methanol / Water*
Runtime	*Cartridge (1.2 L) = 4hrs*
MTBF	*1080 hrs*
Batteries Charged per Cartridge	*3x BB2590, 6x MBITR, 6x Li-145*
Start-up/Shutdown Time	*20min / Instant*

300W INI Methanol System

Requirement	Specifications
Weight	*44lbs w/ Internal Batteries*
Volume	*11.5" x 20.2" x 11.5"*
Internal Battery	*Li 80*
Voltage: APU	*28 VDC*
Fuel	*Methanol*
Runtime	*Cartridge (2L) = 8hrs*
MTBF	*1080 hrs*
Batteries Charged per Cartridge	*3x BB2590, 6x MBITR, 6x Li-145*
Start-up/Shutdown Time	*2 min*

55W UltraCell Methanol System

Requirement	Specifications
Weight	*6.5lbs w/ Internal Battery*
Volume	*12.3" x 8.6" x 3.2"*
Internal Battery	*1x Li-80*
Voltage: APU	*16.8 VDC, 2x - 5V USB ports*
Fuel	*Methanol / Water*
Runtime	*Cartridge (550cc) = 8 hrs*
MTBF	*1080 hrs*
Batteries Charged per Cartridge	*None: APU only*
Start-up/Shutdown Time	*13 min / Instant*

Limited User Test Results

PROTONEX, AMI and Ultracell systems placed in a limited user test excursion for soldier feedback

✓All FC systems performed to specifications

✓Users liked quiet operation of devices

× System size limits all FCs to missions with vehicle access

- Indicated preference for propane vs. methanol due to logistics
- Disliked systems with minimum required time for start up & shut down

Path Forward

- **Size, Weight & Power still concerns with FC systems**

  Requires further miniaturization

- **Cost vs. capability gap with existing FC systems**

  Fuel cell life cycle cost high vs. incumbent solutions

- **Focus Area -Wearable power systems**
  - ✓ ***Including fuel cartridge, system must be wearable (eg. Li-ion battery)***
  - ✓ ***>20W Objective Target***
  - ✓ ***Submit white papers to W15P7T11RA609-0003 (www.fbo.gov)***